What is claimed is:

1.    A method of transmitting an audio stream, comprising:

estimating a perceptual mask for the audio stream, the perceptual mask being based on a human auditory system perceptual threshold;

5          dynamically allocating a hidden sub-channel substantially below the estimated perceptual mask for the audio stream, the dynamic allocation being based on characteristics of the audio stream; and

transmitting additional payload in the hidden sub-channel as part of a composite audio stream, the composite audio stream including the additional payload

10    and narrowband components of the audio stream for which the perceptual mask was estimated.


2.    The method of claim 1 wherein the composite audio stream is an analog signal.

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3.    The method of claim 1 further comprising the step of partitioning the audio stream into audio segments.


4.    The method of claim 3 wherein the step of partitioning is performed prior to

20    the steps of estimating, dynamically allocating and transmitting, and wherein the steps of estimating, dynamically allocating, and transmitting are performed in relation to each audio segment.


5.    The method of claim 1 wherein the step of transmitting additional payload

25    comprises:

removing an audio segment component from within the hidden sub-channel; and

adding the additional payload in place of the removed audio segment component.

6.    The method of claim 5 wherein contents of the additional payload are determined based on characteristics of the audio stream.

5    7.    The method of claim 5 wherein the step of transmitting the additional payload comprises encoding auxiliary information into the additional payload, the auxiliary information relating to how the additional payload should be interpreted in order to correctly restore the additional payload at a receiver.

10    8.    The method of claim 1 wherein the step of transmitting the additional payload comprises:

adding a noise component within the hidden sub-channel, the noise component bearing the additional payload.

15    9.    The method of claim 8 wherein the noise component is introduced as a perturbation to a magnitude of an audio component in the frequency domain.

10.    The method of claim 9 further comprising the steps of:

transforming the audio segment from the time domain to the frequency
20    domain;

calculating a magnitude of each frequency component of the audio segment;

determining a magnitude and sign for each frequency component perturbation;

perturbing each frequency component by the determined frequency
25    component perturbation;

quantizing each perturbed frequency component; and

transforming the audio segment back to the time domain from the frequency domain.

11.     The method of claim 1 wherein the audio stream is a digital audio stream, and wherein the step of transmitting the additional payload comprises:

        modifying certain bits in the digital audio stream to carry the additional payload.

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12.     The method of claim 1 wherein the additional payload includes data for providing a concurrent service.

13.     The method of claim 12 wherein the concurrent service is selected from the
10    group consisting of: instant calling line identification; non-interruption call waiting; concurrent text messaging; display-based interactive services.

14.     The method of claim 1 wherein the additional payload includes data from the original analog audio stream for virtually extending the bandwidth of the audio
15    stream.

15.     The method of claim 14 wherein the data from the original analog audio stream includes data from a lower band.

20    16.     The method of claim 14 wherein the data from the original analog audio stream includes data from an upper band.

17.     An apparatus for transmitting an audio stream, comprising:

        a perceptual mask estimator for estimating a perceptual mask for the audio
25    stream, the perceptual mask being based on a human auditory system perceptual threshold;

        a hidden sub-channel dynamic allocator for dynamically allocating a hidden sub-channel substantially below the estimated perceptual mask for the audio stream, the dynamic allocation being based on characteristics of the audio stream;

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a composite audio stream generator for generating a composite audio stream by including additional payload in the hidden sub-channel of the audio stream; and

a transceiver for receiving the audio stream and for transmitting the composite audio stream.

18.   The apparatus of claim 17 further comprising:

a coder for coding only an upper-band portion of the audio stream.

19.   An apparatus for receiving a composite audio stream having additional payload in a hidden sub-channel of the composite audio stream, comprising:

an extractor for extracting the additional payload from the composite audio stream;

an audio stream reconstructor for restoring the additional payload to form an enhanced analog audio stream; and

a transceiver for receiving the composite audio stream and for transmitting the enhanced audio stream for listening by a user.

20.   The apparatus of claim 19 wherein the extractor further comprises means for estimating a perceptual mask for the audio stream, the perceptual mask being based on a human auditory system perceptual threshold.

21.   The apparatus of claim 19 wherein the extractor further comprises means for determining the location of the additional payload.

22.   The apparatus of claim 19 wherein the extractor further comprises means for decoding auxiliary information from the additional payload, the auxiliary information relating to how the additional payload should be interpreted in order to correctly restore the additional payload.

23.     The apparatus of claim 19 wherein the audio stream reconstructor comprises:

an excitation deriver for deriving an excitation of the audio stream based on a received narrowband audio stream.

5    24.     The apparatus of claim 23 wherein the excitation is derived by using an LPC scheme.

25.     A method of communicating an audio stream, comprising:

coding an upper-band portion of the audio stream;

10     transmitting the coded upper-band portion and an uncoded narrowband portion of the audio stream;

decoding the coded upper-band portion of the audio stream; and

reconstructing the audio stream based on the decoded upper-band portion and the uncoded narrowband portion of the audio stream.

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26.     The method of claim 25 wherein the step of coding the upper-band portion of the audio stream comprises:

determining linear predictive coding (LPC) coefficients of the audio stream, the LPC coefficients representing a spectral envelope of the audio stream; and

20     determining gain coefficients of the audio stream.

27.     The method of claim 25 wherein the upper-band portion of the audio stream is coded and decoded by one of: an upper-band portion of an ITU G.722 codec, and an LPC coefficient portion of an ITU G.729 codec.

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28.     An apparatus for communicating an audio stream, comprising:

a coder for coding an upper-band portion of the audio stream;

a transmitter for transmitting the coded upper-band portion and an uncoded narrowband portion of the audio stream;

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a decoder for decoding the coded upper-band portion of the audio stream; and

a reconstructor reconstructing the audio stream based on the decoded upper-band portion and the uncoded narrowband portion of the audio stream.

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